

## NOTES ON WEATHER IN OTHER PARTS OF THE WORLD.

**North Atlantic.**—WASHINGTON, D. C., Dec. 10.—Emergency orders to beware of enormous icebergs were flashed to all trans-Atlantic shipping by the Naval Hydrographic Office yesterday. All vessels were advised to take the summer lanes immediately. Ordinarily the summer lanes are not used until about February 1. Great masses of ice, however, are already floating through the winter lanes, constituting a grave menace to shipping.—*Washington Times*, Dec. 10, 1922.

**PLYMOUTH, ENGLAND**, Dec. 31.—The American steamship *President Harding* arrived here to-day from New York. During the voyage the vessel encountered four days of gales with tremendous seas.—*New York Times*, Jan. 1, 1923.

**France.**—PERPIGNAN, Dec. 7.—A train was blown off the track near the Fitou station yesterday by a mistral of great violence.—*Binghamton Press*, Dec. 7, 1922.

**Italy.**—ROME, Dec. 13.—Italy is suffering from an exceptional cold wave. Five persons were frozen to

death in Rome last night and several similar cases are reported from other cities.

The Appenine Mountains are completely covered with snow. Wolves driven desperate by the lack of food have descended to the plains and are seen almost at the gates of the capital.—*Washington Times*, Dec. 13, 1922.

**Greece.**—ATHENS, Dec. 14.—The Orient Express, due in Athens Monday evening, has been snowed in by a blizzard in the Macedonian Mountains for the last 24 hours. Three feet of snow have fallen in the mountain districts, and trains that should have left that city for the north are being detained here.—*New York Post*, Dec. 14, 1922.

**Japan.**—TSURUGA, Dec. 2.—While the great majority of farmers of Japan have had a prosperous year with bountiful crops, those in Asaigun, Shiga prefecture, in the center of which is Lake Biwa, have been impoverished, the long drought having destroyed their crops.—*Chicago Evening Post*, Dec. 26, 1922.

## DETAILS OF THE WEATHER IN THE UNITED STATES.

## GENERAL CONDITIONS.

The outstanding feature of December weather was the rapid east-southeastward movement of at least four great anticyclones from the Canadian Northwest to the Atlantic. The movements took place during the following named dates:

The first, 4th to 7th, inclusive.

The second, 8th to 12th, inclusive.

The third, 10th to 14th, inclusive.

The fourth, 15th to 19th, inclusive.

On the date last named an anticyclone occupied the Great Basin region; it persisted practically until the end of the month and during that time the movement of anticyclones from the Canadian Northwest ceased and cyclones entered the continent generally south of the mouth of the Columbia River.

An unusually large number of cyclones (24) was observed during the month.

The drought in eastern sections that had prevailed since September was terminated.

## CYCLONES AND ANTICYCLONES.

By W. P. DAY.

The number of low-pressure areas greatly exceeded the normal and generally speaking the day-to-day movement was also above the normal. High-pressure areas were mostly of the Alberta type, moving in paths somewhat farther north than is usual during December. There were no abnormal developments, except a storm off the Colorado type which moved eastward and passed off the Virginia Capes into the Atlantic, causing whole gales from the northeast on the New England coast. The number of cyclones (Lows) and anticyclones (HIGHS) by types follows:

| CYCLONES.   | Al-<br>berta. | North<br>Paci-<br>fic. | South<br>Paci-<br>fic. | North-<br>ern<br>Rocky<br>Moun-<br>tain. | Colo-<br>rado. | Texas. | East<br>Gulf. | South<br>Atlan-<br>tic. | Central. | Total. |
|---|---------------|------------------------|------------------------|--|----------------|--------|---------------|-------------------------|----------|--------|
| December, 1922..                                  | 6.0           | 6.0                    | 1.0                    | .....                                    | 6.0            | 1.0    | .....         | 4.0                     | .....    | 24.0   |
| Average number,<br>1892-1912, in-<br>clusive..... | 4.3           | 2.5                    | 0.8                    | 0.3                                      | 1.1            | 2.5    | 0.2           | 0.3                     | 0.4      | 12.4   |

  

| ANTICYCLONES.                                  | North<br>Paci-<br>fic. | South<br>Paci-<br>fic. | Alberta. | Plateau<br>and<br>Rocky<br>Moun-<br>tain<br>region. | Hudson<br>Bay. | Total. |
|--|------------------------|------------------------|----------|---|----------------|--------|
| December, 1922.....                            | .....                  | 2.0                    | 6.0      | 2.0   | 1.0            | 11.0   |
| Average number, 1892-1912, in-<br>clusive..... | 1.1                    | 1.2                    | 4.7      | 1.3   | 0.5            | 8.8    |

## FREE-AIR CONDITIONS.

By W. R. GREGG, Meteorologist.

Free-air conditions for the month of December were in general not far from normal. As indicated in Table 1, temperatures were somewhat below normal at Ellendale, N. Dak., and above at Groesbeck, Tex. In both cases smaller departures prevailed in the upper than in the lower levels. At intermediate stations temperatures were very close to normal, variations as a rule amounting to less than 1° C. The latitudinal distribution above indicated agrees well with the conditions shown in Climatological Chart III, viz, negative departures along the northern border and positive along the southern, with nearly normal temperatures over a fairly wide belt between these two regions. Although departures from normal for the month as a whole were not large in any part of the country, it should be noted that the averages are based upon individual values which vary between rather wide extremes, the usual case at this time of year,

particularly in the Northern States. During this month, for example, abnormally low temperatures prevailed in the Northwest, Montana, the Dakotas, etc., from about the 5th to the 18th. The effect of these low temperatures upon the monthly mean was largely overcome by the succeeding warm spell. Similarly, in the South, especially in Texas and adjoining States, abnormally high temperatures prevailed in the first part of the month, although extremes in this part of the country were not as great, nor are they ever as great, as in the northern part. These wide departures are reflected in part, never completely, in the upper levels. Thus, during the Northwest cold spell free-air temperatures up to 2 or 3 kilometers above Ellendale were almost always higher than were those at the surface; on the other hand the lapse rate above Groesbeck during the warm spell in the South was considerably above (almost double) its normal value. In general, then, temperatures in the free-air depart less widely from the mean than do those at and near the surface.

In connection with the kite flight at Broken Arrow on the afternoon of the 4th, the observer submits the following note:

Before this flight was started a line of cumulus-topped clouds was noted above the northwestern horizon, denoting the approach of a windshift line. It was decided to make the flight and have it over before the line reached the station. However the wind shift was only a few miles away when reeling in was begun at 3:38 p. m. and it passed overhead at 3:55 p. m. while two kites were still in the air. The line extended from northeast to southwest and from horizon to horizon. It consisted of a dark roll of St.-Cu. followed by lighter St.-Cu. Considerable turbulence was noted in the clouds at the wind-shift line and some rolling about a horizontal axis.

This condition may be considered a very good example of the "squall line" as developed by the Bjerknes hypothesis. There is evidence of a south component in the wind at higher elevations after the direction at the surface and lowest levels had become northwesterly. The kite flight of the following morning (5th) indicated, as a result of this south component, a higher temperature at the greatest altitude reached (1,817 m.) than at the surface.

At Groesbeck, on the morning of the 15th, the temperature at 1,000 m. above the ground was 15° C. higher than at the surface. Such a large inversion in this latitude is very uncommon, and it is of interest to note that the warm air found at this height above the surface is not the result of nocturnal radiation but, instead, a consequence of air importation. On this occasion the temperature of the air on the 14th, the day previous, at 1,000 m. was maintained during the following night, as there was a strong south component persisting in the upper winds throughout this period.

Relative humidities and vapor pressures differed little from the normal, except that a considerable excess in vapor pressure prevailed in the lower levels at Groesbeck, due to the fairly high temperatures that prevailed at that station.

As indicated in Table 2, resultant winds for the month were on the whole close to normal, except in the lowest levels at Broken Arrow and Due West. The agreement in directions is especially close. Velocities were somewhat above normal at Drexel, Ellendale, and Royal Center, but the difference is generally less than 3 m. p. s.

Wind velocities of 40 m. p. s. or more were observed as follows:

| Station.             | Date.    | Velocity. | Direction. | Altitude |
|----------------------|----------|-----------|------------|----------|
|                      |          | m. p. s.  |            | m.       |
| Aberdeen, Md.        | Sept. 5  | 41        | WNW.       | 3,100    |
| Do.                  | Sept. 13 | 44        | WNW.       | 4,200    |
| Dahlgren, Va.        | Sept. 6  | 40        | WNW.       | 5,000    |
| Drexel, Nebr.        | Sept. 12 | 42        | WNW.       | 4,100    |
| Do.                  | Sept. 24 | 45        | NW.        | 3,700    |
| Due West, S. C.      | Sept. 22 | 43        | NW.        | 5,500    |
| Ellendale, N. Dak.   | Sept. 13 | 40        | W.         | 4,600    |
| Do.                  | Sept. 17 | 40        | WNW.       | 5,000    |
| Do.                  | Sept. 24 | 40        | NW.        | 4,000    |
| Mitchel Field, N. Y. | Sept. 16 | 43        | W.         | 3,400    |
| Do.                  | Sept. 19 | 40        | WNW.       | 3,200    |
| Do.                  | Sept. 20 | 45        | N.         | 2,700    |
| Royal Center, Ind.   | Sept. 5  | 48        | WNW.       | 4,200    |
| Washington, D. C.    | Sept. 6  | 44        | NW.        | 3,300    |

At this season of the year easterly winds rarely occur in the upper levels, i. e., above 4 or 5 kilometers. In the present month no such winds were observed in northern or central latitudes. They did occur, however, in the Southern States, as follows:

Groesbeck, Tex., on the 19th, and

Key West, Fla., on the 13th and 17th.

TABLE 1.—Free-air temperatures, relative humidities, and vapor pressures during December, 1922..

TEMPERATURE (° C.).

| Altitude,<br>m. s. l.<br>(m.) | Broken<br>Arrow,<br>Okla.<br>(233m.) |   | Drexel,<br>Nebr.<br>(396m.) |   | Due West,<br>S. C.<br>(217m.) |   | Ellendale,<br>N. Dak.<br>(444m.) |   | Groesbeck,<br>Tex.<br>(141m.) |   | Royal<br>Center,<br>Ind.<br>(225m.) |   |
|-------------------------------|--------------------------------------|---|-----------------------------|---|-------------------------------|---|----------------------------------|---|-------------------------------|---|-------------------------------------|---|
|                               | Mean.                                | De-<br>parture<br>from<br>5-year<br>mean. | Mean.                       | De-<br>parture<br>from<br>5-year<br>mean. | Mean.                         | De-<br>parture<br>from<br>5-year<br>mean. | Mean.                            | De-<br>parture<br>from<br>5-year<br>mean. | Mean.                         | De-<br>parture<br>from<br>5-year<br>mean. | Mean.                               | De-<br>parture<br>from<br>5-year<br>mean. |
| Surface..                     | 5.8                                  | +0.3                                      | -3.8                        | +0.3                                      | 8.0                           | -0.6                                      | -11.1                            | -2.9                                      | 13.3                          | +3.0                                      | -1.8                                | -0.4                                      |
| 250.....                      | 5.8                                  | +0.3                                      | ...                         | ...                                       | 7.9                           | -0.6                                      | ...                              | ...                                       | 13.0                          | +2.8                                      | -1.9                                | -0.4                                      |
| 500.....                      | 5.1                                  | +0.2                                      | -3.9                        | +0.1                                      | 7.7                           | -0.3                                      | -10.9                            | -2.9                                      | 12.3                          | +2.5                                      | -3.0                                | -0.4                                      |
| 750.....                      | 4.4                                  | -0.4                                      | -3.6                        | -0.1                                      | 7.7                           | 0.0                                       | -10.2                            | -3.0                                      | 11.9                          | +2.3                                      | -2.6                                | +0.5                                      |
| 1,000....                     | 4.8                                  | -0.6                                      | -2.4                        | +0.2                                      | 7.5                           | +0.1                                      | -9.4                             | -3.2                                      | 11.7                          | +2.2                                      | -1.9                                | +1.0                                      |
| 1,250....                     | 5.2                                  | -0.3                                      | -1.7                        | +0.4                                      | 7.2                           | +0.4                                      | -8.9                             | -3.2                                      | 11.2                          | +2.2                                      | -2.1                                | +0.9                                      |
| 1,500....                     | 5.2                                  | +0.1                                      | -1.7                        | +0.6                                      | 6.2                           | +0.4                                      | -8.4                             | -2.7                                      | 10.3                          | +2.0                                      | -2.3                                | +0.8                                      |
| 2,000....                     | 3.8                                  | +0.4                                      | -2.8                        | +1.0                                      | 4.2                           | +0.1                                      | -9.4                             | -2.4                                      | 7.9                           | +1.3                                      | -4.3                                | +0.1                                      |
| 2,500....                     | 1.4                                  | +0.3                                      | -5.6                        | +0.5                                      | 1.7                           | -0.3                                      | -11.4                            | -2.2                                      | 5.8                           | +1.4                                      | -6.5                                | -0.1                                      |
| 3,000....                     | -1.2                                 | +0.2                                      | -8.2                        | +0.4                                      | -0.1                          | +0.2                                      | -13.0                            | -1.1                                      | 3.2                           | +1.3                                      | -9.1                                | -0.4                                      |
| 3,500....                     | -4.0                                 | 0.0                                       | -11.0                       | +0.2                                      | -0.9                          | +1.4                                      | -18.0                            | -2.3                                      | 0.4                           | +1.3                                      | -12.7                               | -1.2                                      |
| 4,000....                     | -6.8                                 | 0.0                                       | -13.4                       | +0.6                                      | -3.3                          | +2.0                                      | -18.3                            | -1.7                                      | -2.3                          | +1.3                                      | -16.3                               | -1.4                                      |
| 4,500....                     | -9.2                                 | +0.4                                      | -17.6                       | -0.6                                      | ...                           | ...                                       | ...                              | ...                                       | -4.9                          | +0.9                                      | ...                                 | ...                                       |
| 5,000....                     | -13.7                                | -0.1                                      | ...                         | ...                                       | ...                           | ...                                       | ...                              | ...                                       | -7.4                          | +1.0                                      | ...                                 | ...                                       |

RELATIVE HUMIDITY (%).

|           |    |    |     |     |     |     |     |     |    |    |     |     |
|-----------|----|----|-----|-----|-----|-----|-----|-----|----|----|-----|-----|
| Surface.. | 65 | -5 | 77  | -7  | 81  | +6  | 86  | +3  | 69 | -4 | 79  | -1  |
| 250.....  | 65 | -5 | ... | ... | 80  | +6  | ... | ... | 69 | -2 | 78  | -1  |
| 500.....  | 62 | -2 | 68  | -6  | 73  | +5  | 84  | +3  | 69 | +3 | 72  | -3  |
| 750.....  | 62 | +3 | 60  | -7  | 68  | +4  | 76  | +2  | 67 | +5 | 62  | -8  |
| 1,000.... | 57 | +6 | 56  | -5  | 66  | +5  | 70  | +3  | 61 | +5 | 54  | -9  |
| 1,250.... | 51 | +5 | 53  | -3  | 60  | +7  | 66  | +4  | 56 | +5 | 50  | -7  |
| 1,500.... | 46 | +3 | 52  | -2  | 65  | +7  | 63  | +4  | 52 | +5 | 48  | -5  |
| 2,000.... | 42 | +3 | 49  | -3  | 60  | +6  | 61  | +5  | 44 | +5 | 49  | 0   |
| 2,500.... | 42 | +4 | 49  | -3  | 57  | +9  | 60  | +3  | 35 | +1 | 50  | +2  |
| 3,000.... | 42 | +4 | 45  | -7  | 47  | +5  | 59  | +1  | 29 | -2 | 50  | +2  |
| 3,500.... | 44 | +6 | 43  | -9  | 44  | +3  | 61  | +3  | 26 | -3 | 58  | +7  |
| 4,000.... | 45 | +7 | 39  | -13 | 46  | +4  | 59  | +4  | 24 | -5 | 66  | +12 |
| 4,500.... | 46 | +7 | 43  | -11 | ... | ... | ... | ... | 23 | -5 | ... | ... |
| 5,000.... | 47 | +7 | ... | ... | ... | ... | ... | ... | 23 | -5 | ... | ... |

VAPOR PRESSURE (mb.).

|           |      |       |      |       |      |       |      |       |       |       |      |       |
|-----------|------|-------|------|-------|------|-------|------|-------|-------|-------|------|-------|
| Surface.. | 6.54 | -0.14 | 3.32 | -0.40 | 9.41 | -0.55 | 2.58 | -0.43 | 11.51 | +1.59 | 4.38 | -0.26 |
| 250.....  | 6.49 | -0.13 | ...  | ...   | 9.27 | -0.55 | ...  | ...   | 11.27 | +1.67 | 4.29 | -0.29 |
| 500.....  | 5.96 | -0.17 | 3.14 | -0.42 | 8.34 | -0.52 | 2.51 | -0.44 | 10.63 | +1.57 | 3.63 | -0.37 |
| 750.....  | 5.62 | -0.45 | 2.85 | -0.45 | 7.81 | -0.56 | 2.35 | -0.42 | 9.96  | +2.03 | 3.23 | -0.33 |
| 1,000.... | 5.14 | -0.65 | 2.84 | -0.29 | 7.31 | -0.61 | 2.29 | -0.34 | 8.82  | +1.90 | 2.97 | -0.23 |
| 1,250.... | 4.56 | -0.56 | 2.85 | -0.08 | 6.99 | -0.80 | 2.24 | -0.29 | 7.73  | +1.70 | 2.79 | -0.10 |
| 1,500.... | 4.05 | -0.52 | 2.75 | +0.02 | 6.30 | -0.72 | 2.17 | -0.19 | 6.62  | +1.47 | 2.66 | +0.02 |
| 2,000.... | 3.42 | -0.52 | 2.37 | +0.07 | 5.07 | -0.50 | 1.98 | -0.01 | 4.48  | +0.85 | 2.33 | +0.19 |
| 2,500.... | 3.91 | -0.50 | 1.93 | -0.03 | 4.01 | -0.51 | 1.68 | -0.01 | 2.75  | +0.11 | 2.01 | +0.23 |
| 3,000.... | 2.49 | -0.40 | 1.46 | -0.15 | 3.01 | -0.28 | 1.29 | -0.07 | 1.75  | -0.30 | 1.61 | +0.15 |
| 3,500.... | 2.20 | -0.33 | 1.09 | -0.21 | 2.70 | -0.41 | 0.95 | -0.10 | 1.23  | -0.31 | 1.25 | -0.02 |
| 4,000.... | 1.92 | -0.28 | 0.58 | -0.39 | 2.62 | -0.84 | 0.89 | +0.04 | 0.97  | -0.34 | 0.93 | -0.11 |
| 4,500.... | 1.83 | -0.27 | 0.42 | -0.23 | ...  | ...   | ...  | ...   | 0.80  | -0.31 | ...  | ...   |
| 5,000.... | 1.69 | +0.22 | ...  | ...   | ...  | ...   | ...  | ...   | 0.71  | -0.23 | ...  | ...   |

TABLE 2.—Free-air resultant winds (m. p. a.) during December, 1922.

| Altitude,<br>m. s. l.<br>(m.) | Broken Arrow, Okla.<br>(233m.) |      |              |      | Drexel, Nebr.<br>(396m.) |       |              |       | Due West, S. C.<br>(217m.) |       |              |      | Ellendale, N. Dak.<br>(444m.) |       |              |           | Groesbeck, Tex.<br>(141m.) |           |              |           | Royal Center, Ind.<br>(225m.) |           |              |       |
|-------------------------------|--------------------------------|------|--------------|------|--------------------------|-------|--------------|-------|----------------------------|-------|--------------|------|-------------------------------|-------|--------------|-----------|----------------------------|-----------|--------------|-----------|-------------------------------|-----------|--------------|-------|
|                               | Mean.                          |      | 5-year mean. |      | Mean.                    |       | 5-year mean. |       | Mean.                      |       | 2-year mean. |      | Mean.                         |       | 5-year mean. |           | Mean.                      |           | 5-year mean. |           | Mean.                         |           | 5-year mean. |       |
|                               | Dir.                           | Vel. | Dir.         | Vel. | Dir.                     | Vel.  | Dir.         | Vel.  | Dir.                       | Vel.  | Dir.         | Vel. | Dir.                          | Vel.  | Dir.         | Vel.      | Dir.                       | Vel.      | Dir.         | Vel.      | Dir.                          | Vel.      |              |       |
| Surface.....                  | N. 49° W.                      | 1.7  | S. 60° W.    | 1.2  | S. 48° W.                | 1.5   | W.           | 1.1   | N. 87° E.                  | 0.6   | S. 62° W.    | 0.9  | N. 71° W.                     | 3.7   | N. 54° W.    | 3.4       | S. 55° W.                  | 2.2       | S. 36° W.    | 1.2       | S. 34° W.                     | 1.2       | S. 50° W.    | 2.1   |
| 250.....                      | N. 46° W.                      | 1.7  | S. 52° W.    | 1.3  | .....                    | ..... | .....        | ..... | N. 85° E.                  | 0.6   | S. 60° W.    | 1.1  | .....                         | ..... | .....        | S. 51° W. | 2.7                        | S. 32° W. | 1.6          | S. 26° W. | 1.9                           | S. 50° W. | 2.4          |       |
| 500.....                      | S. 43° W.                      | 1.3  | S. 43° W.    | 3.4  | S. 66° W.                | 2.4   | N. 88° W.    | 1.8   | S. 34° W.                  | 1.1   | S. 67° W.    | 3.3  | N. 78° W.                     | 4.4   | N. 61° W.    | 3.7       | S. 50° W.                  | 4.2       | S. 50° W.    | 3.2       | S. 59° W.                     | 4.5       | S. 57° W.    | 5.0   |
| 750.....                      | S. 53° W.                      | 2.0  | S. 48° W.    | 4.3  | N. 89° W.                | 4.1   | N. 74° W.    | 3.5   | S. 64° W.                  | 2.5   | S. 76° W.    | 5.0  | N. 75° W.                     | 6.4   | N. 60° W.    | 5.7       | S. 55° W.                  | 5.4       | S. 52° W.    | 4.8       | S. 72° W.                     | 7.0       | S. 66° W.    | 6.6   |
| 1,000.....                    | S. 64° W.                      | 2.5  | S. 60° W.    | 4.5  | S. 85° W.                | 5.5   | N. 75° W.    | 5.2   | S. 61° W.                  | 3.3   | S. 82° W.    | 6.1  | N. 69° W.                     | 8.9   | N. 58° W.    | 6.8       | S. 56° W.                  | 5.9       | S. 52° W.    | 5.8       | W.                            | 7.9       | S. 79° W.    | 7.8   |
| 1,250.....                    | S. 72° W.                      | 3.2  | S. 77° W.    | 4.8  | N. 89° W.                | 7.2   | N. 76° W.    | 5.4   | S. 61° W.                  | 4.9   | S. 81° W.    | 6.7  | N. 66° W.                     | 10.0  | N. 56° W.    | 7.6       | S. 59° W.                  | 6.6       | S. 60° W.    | 6.6       | S. 86° W.                     | 10.6      | S. 83° W.    | 9.8   |
| 1,500.....                    | S. 77° W.                      | 4.0  | S. 82° W.    | 5.2  | N. 87° W.                | 9.2   | N. 78° W.    | 6.9   | S. 63° W.                  | 6.2   | W.           | 8.3  | N. 65° W.                     | 11.2  | N. 58° W.    | 8.9       | S. 63° W.                  | 8.3       | S. 64° W.    | 7.4       | W.                            | 13.1      | S. 88° W.    | 11.0  |
| 2,000.....                    | S. 76° W.                      | 6.1  | S. 86° W.    | 6.9  | N. 87° W.                | 11.8  | N. 79° W.    | 8.9   | S. 66° W.                  | 8.3   | N. 88° W.    | 8.9  | N. 66° W.                     | 13.6  | N. 60° W.    | 10.1      | S. 67° W.                  | 8.2       | S. 70° W.    | 8.6       | N. 89° W.                     | 14.7      | N. 89° W.    | 12.3  |
| 2,500.....                    | S. 84° W.                      | 8.1  | N. 89° W.    | 9.6  | N. 84° W.                | 13.8  | N. 79° W.    | 11.4  | S. 81° W.                  | 9.8   | N. 82° W.    | 12.6 | N. 69° W.                     | 15.9  | N. 65° W.    | 12.2      | S. 70° W.                  | 9.7       | S. 75° W.    | 10.0      | N. 80° W.                     | 16.9      | N. 67° W.    | 13.3  |
| 3,000.....                    | S. 86° W.                      | 9.9  | N. 86° W.    | 11.6 | N. 82° W.                | 15.6  | N. 80° W.    | 13.4  | S. 86° W.                  | 14.8  | N. 85° W.    | 15.0 | N. 72° W.                     | 16.9  | N. 70° W.    | 13.7      | S. 70° W.                  | 12.2      | S. 72° W.    | 11.6      | N. 88° W.                     | 16.8      | S. 87° W.    | 13.8  |
| 3,500.....                    | N. 84° W.                      | 9.9  | N. 84° W.    | 12.8 | N. 76° W.                | 17.3  | N. 84° W.    | 15.2  | S. 80° W.                  | 14.4  | N. 88° W.    | 13.7 | N. 77° W.                     | 19.2  | N. 79° W.    | 15.0      | S. 73° W.                  | 12.2      | S. 74° W.    | 11.9      | N. 72° W.                     | 14.0      | S. 84° W.    | 11.2  |
| 4,000.....                    | N. 88° W.                      | 7.1  | N. 82° W.    | 10.9 | N. 76° W.                | 18.8  | N. 86° W.    | 17.0  | N. 82° W.                  | 12.5  | N. 78° W.    | 12.5 | N. 80° W.                     | 20.0  | N. 79° W.    | 14.8      | S. 68° W.                  | 12.8      | S. 73° W.    | 11.4      | S. 68° W.                     | 18.6      | S. 74° W.    | 12.7  |
| 4,500.....                    | N. 78° W.                      | 10.5 | N. 79° W.    | 13.1 | N. 68° W.                | 19.9  | N. 72° W.    | 18.4  | .....                      | ..... | N. 70° W.    | 13.2 | .....                         | ..... | S. 73° W.    | 16.2      | S. 74° W.                  | 11.2      | N. 89° W.    | 11.2      | .....                         | .....     | .....        | ..... |
| 5,000.....                    | S. 68° W.                      | 14.9 | N. 88° W.    | 14.7 | N. 68° W.                | 20.8  | N. 78° W.    | 17.7  | .....                      | ..... | N. 68° W.    | 12.5 | .....                         | ..... | S. 77° W.    | 15.3      | S. 78° W.                  | 13.4      | N. 84° W.    | 13.6      | .....                         | .....     | .....        | ..... |

## THE WEATHER ELEMENTS.

By P. C. DAY, Meteorologist, in Charge of Division.

## PRESSURE AND WINDS.

The distribution of the average sea-level pressure during December, 1922, presented some features not frequently observed on charts of similar character for that month in other years, notably the extensive displacement of the high area normal to the Southeastern States in winter which, during the present month, had an unusual extension into the New England States, due to the southward movement of high-pressure areas from the Hudson Bay territory, a condition infrequently experienced so early in the winter. Also the Plateau high pressure, which usually persists with much strength, was materially weakened, and occupied a position well south of that usual to the period of the year. This weakening and displacement were due mainly to the persistence of high pressure over southeastern Alaska, forcing the winter cyclones of that region inland at points farther south than usual, particularly during the early portion of the month. Finally, the lowering of the average pressure, normally only feebly apparent, along the eastern slope of the Rocky Mountains was much more fully developed than usual.

The changes in atmospheric pressure during December, 1922, as compared with the preceding month, likewise exhibited distinct departures from those usually prevailing. Under normal conditions pressure in December increases over that for November in all portions of the United States save in New England and the far Northwest, where, due to more stormy conditions, it is usually distinctly less. During the current month this was reversed as to eastern districts, where the pressure was distinctly higher than in November, while in the Northwest the area of decreased pressure was greatly extended and the decreases far greater than normal.

Due to the rapid movement of cyclones and anticyclones across the country, the atmospheric circulation was much complicated, the prevailing wind directions frequently differed greatly at near-by points, and no extensive areas had winds closely conforming to the indications of the pressure gradients.

Some high winds occurred over the north Pacific coast districts during the early part of the month and again near the end, and the cyclonic storm that moved northeasterly from the middle Mississippi Valley to southern New England from the 27th to 29th was attended by gales and high winds over the middle and north Atlantic coasts.

A tabular statement of the main facts concerning the damaging storms of the month follows at the end of this section.

## TEMPERATURE.

December as a whole experienced marked variations of temperature for different periods of the month and for the various portions of the country.

The first few days were decidedly warm in most sections of the South from Texas eastward, and warmth to a somewhat less degree was experienced over the entire country east of the Rocky Mountains, save over Montana and portions of North Dakota. Here, particularly in northern Montana, severe cold was experienced and the period was moderately cold over most of the country to westward of the Rocky Mountains.

During the period from the 5th to 12th severe cold continued in Montana and adjacent States and to the westward of the Rocky Mountains, and extended over the northern and portions of the central districts to New England. In portions of Montana this week was from 25 to 30 degrees colder than is usually observed in December. This period continued moderately warm in most southern, and portions of the central, districts.

The week ending the 19th continued cold over all northern districts, the temperatures along or near the northern border ranging from 20 to 30 degrees below normal; in western Montana some of the lowest temperatures ever observed in December were reported. The cold weather extended southward over the Great Plains to the Rio Grande and into most of the eastern districts, the weather continuing moderately warm, however, over the East Gulf and South Atlantic States; the week was moderately warm in the far Southwest.

The period from the 19th to 26th experienced a remarkable rise in temperature over the Northwestern States. There was a very general warming up over nearly all parts of the country, except that severe cold continued during the first few days in the Northeastern States. The last few days were notably warm, particularly about Christmas, and that day was the warmest ever known in many portions of the central valleys and Great Plains.

The last few days of the month continued moderately warm over most districts, although there were sharp falls in temperature over the Northeastern States on the 26th and 27th, and the weather was cold along the Atlantic coast on the 29th and 30th.

The month as a whole was colder than normal over all northern portions of the country and in Canada as well,